



Colville Confederated Tribes

Watershed Restoration
Cycles of monitoring &
implementation

***Where is the Colville
Reservation?***



***106 & 319
One step after another***

1. Resource & activity monitoring (106)
2. Prioritize and implement projects (319)
3. Monitor performance & resource condition (319 & 106)

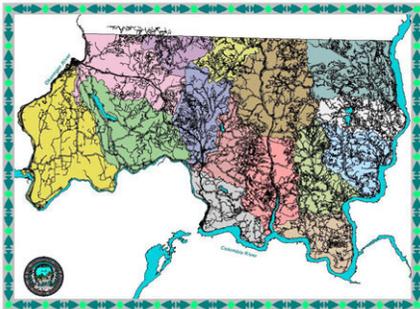
Water Quality Monitoring



Monitoring Activities & Effects



Reservation Roads



Reservation Road Length & Area

Length = 7433 miles
Area = 20,000 acres
1.5% of Reservation area

Road Scenes



Road Impacts

- Sedimentation
- Changed hydrology
- Lost riparian function
- Channel & habitat degradation
- Chemical contamination

***Survey of Watershed Impacts
from Roads***



Road monitoring goals

- Watershed orientation
- Real data from the field
- Cover the ground efficiently
- Identify/locate problems & allow prioritization
- Create a geodatabase

Road survey design

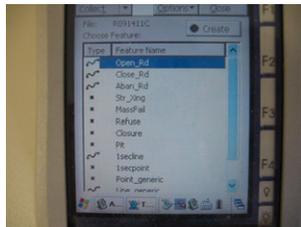
- Relies on Pathfinder & Arcview software
- Data input using data dictionary
- Using Trimble GPS data collector
- Work contracted

The Data Dictionary

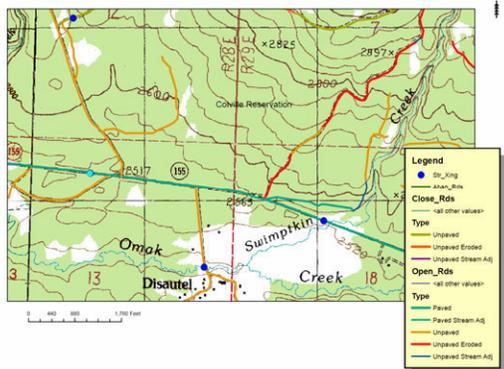
- Contains drop-down menus for choosing values
- Map feature choices are:
 - Open road
 - Closed road
 - Abandoned road

The Data Dictionary

- Map features continued:
 - Stream crossing
 - Mass failure
 - Road closure
 - Pit



Survey Products- map files



Prioritizing Problems

- Crossings with high erosion
- Crossings where stream width greatly exceeds culvert diameter
- Eroding roads intersecting streams
- Stream adjacent roads
- Diverted streams

Work with landowners



- Colville Tribes have an Integrated Resources Mgt Plan
- Forestry, Range & Fish & Wildlife programs
- Interdisciplinary planning & review

Design the project

- WA Forest Practices Board Manual
 - Provides 2 methods of sizing culverts
- WA Fish & Wildlife Habitat Technical Assistance
- Natural Resources Conservation Service
- Road engineers
- Manufacturer's specs & bulletins

Crossing replacement



Cross drain installation



Armoring



Drain Dips



Measure 319 performance

- 2 year's monitoring
- Inspect work site each June
- Photo & visual monitoring
- Collecting sediment data
- Review of WQ monitoring station data

WARSEM

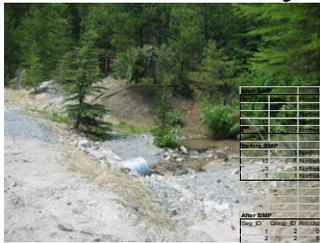
- The Washington Road Surface Erosion Model
- Calculates average annual road erosion and delivery to stream
- Factors in geology, precipitation, road surface, gradient, & dimensions for segments delivering to channel

WARSEM monitoring

- Perform before/after 319 implementation
- May include as component of 106 road survey



Monitoring Results



1. Photos
2. WARSEM data

Tag	Ring	Size	Length	Width	Depth	Volume	Weight
1	1	1.00	1.00	1.00	1.00	1.00	1.00
2	2	2.00	2.00	2.00	2.00	2.00	2.00
3	3	3.00	3.00	3.00	3.00	3.00	3.00
4	4	4.00	4.00	4.00	4.00	4.00	4.00
5	5	5.00	5.00	5.00	5.00	5.00	5.00
6	6	6.00	6.00	6.00	6.00	6.00	6.00
7	7	7.00	7.00	7.00	7.00	7.00	7.00
8	8	8.00	8.00	8.00	8.00	8.00	8.00
9	9	9.00	9.00	9.00	9.00	9.00	9.00
10	10	10.00	10.00	10.00	10.00	10.00	10.00
11	11	11.00	11.00	11.00	11.00	11.00	11.00
12	12	12.00	12.00	12.00	12.00	12.00	12.00
13	13	13.00	13.00	13.00	13.00	13.00	13.00
14	14	14.00	14.00	14.00	14.00	14.00	14.00
15	15	15.00	15.00	15.00	15.00	15.00	15.00
16	16	16.00	16.00	16.00	16.00	16.00	16.00
17	17	17.00	17.00	17.00	17.00	17.00	17.00
18	18	18.00	18.00	18.00	18.00	18.00	18.00
19	19	19.00	19.00	19.00	19.00	19.00	19.00
20	20	20.00	20.00	20.00	20.00	20.00	20.00
21	21	21.00	21.00	21.00	21.00	21.00	21.00
22	22	22.00	22.00	22.00	22.00	22.00	22.00
23	23	23.00	23.00	23.00	23.00	23.00	23.00
24	24	24.00	24.00	24.00	24.00	24.00	24.00
25	25	25.00	25.00	25.00	25.00	25.00	25.00
26	26	26.00	26.00	26.00	26.00	26.00	26.00
27	27	27.00	27.00	27.00	27.00	27.00	27.00
28	28	28.00	28.00	28.00	28.00	28.00	28.00
29	29	29.00	29.00	29.00	29.00	29.00	29.00
30	30	30.00	30.00	30.00	30.00	30.00	30.00
31	31	31.00	31.00	31.00	31.00	31.00	31.00
32	32	32.00	32.00	32.00	32.00	32.00	32.00
33	33	33.00	33.00	33.00	33.00	33.00	33.00
34	34	34.00	34.00	34.00	34.00	34.00	34.00
35	35	35.00	35.00	35.00	35.00	35.00	35.00
36	36	36.00	36.00	36.00	36.00	36.00	36.00
37	37	37.00	37.00	37.00	37.00	37.00	37.00
38	38	38.00	38.00	38.00	38.00	38.00	38.00
39	39	39.00	39.00	39.00	39.00	39.00	39.00
40	40	40.00	40.00	40.00	40.00	40.00	40.00
41	41	41.00	41.00	41.00	41.00	41.00	41.00
42	42	42.00	42.00	42.00	42.00	42.00	42.00
43	43	43.00	43.00	43.00	43.00	43.00	43.00
44	44	44.00	44.00	44.00	44.00	44.00	44.00
45	45	45.00	45.00	45.00	45.00	45.00	45.00
46	46	46.00	46.00	46.00	46.00	46.00	46.00
47	47	47.00	47.00	47.00	47.00	47.00	47.00
48	48	48.00	48.00	48.00	48.00	48.00	48.00
49	49	49.00	49.00	49.00	49.00	49.00	49.00
50	50	50.00	50.00	50.00	50.00	50.00	50.00
51	51	51.00	51.00	51.00	51.00	51.00	51.00
52	52	52.00	52.00	52.00	52.00	52.00	52.00
53	53	53.00	53.00	53.00	53.00	53.00	53.00
54	54	54.00	54.00	54.00	54.00	54.00	54.00
55	55	55.00	55.00	55.00	55.00	55.00	55.00
56	56	56.00	56.00	56.00	56.00	56.00	56.00
57	57	57.00	57.00	57.00	57.00	57.00	57.00
58	58	58.00	58.00	58.00	58.00	58.00	58.00
59	59	59.00	59.00	59.00	59.00	59.00	59.00
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61	61	61.00	61.00	61.00	61.00	61.00	61.00
62	62	62.00	62.00	62.00	62.00	62.00	62.00
63	63	63.00	63.00	63.00	63.00	63.00	63.00
64	64	64.00	64.00	64.00	64.00	64.00	64.00
65	65	65.00	65.00	65.00	65.00	65.00	65.00
66	66	66.00	66.00	66.00	66.00	66.00	66.00
67	67	67.00	67.00	67.00	67.00	67.00	67.00
68	68	68.00	68.00	68.00	68.00	68.00	68.00
69	69	69.00	69.00	69.00	69.00	69.00	69.00
70	70	70.00	70.00	70.00	70.00	70.00	70.00
71	71	71.00	71.00	71.00	71.00	71.00	71.00
72	72	72.00	72.00	72.00	72.00	72.00	72.00
73	73	73.00	73.00	73.00	73.00	73.00	73.00
74	74	74.00	74.00	74.00	74.00	74.00	74.00
75	75	75.00	75.00	75.00	75.00	75.00	75.00
76	76	76.00	76.00	76.00	76.00	76.00	76.00
77	77	77.00	77.00	77.00	77.00	77.00	77.00
78	78	78.00	78.00	78.00	78.00	78.00	78.00
79	79	79.00	79.00	79.00	79.00	79.00	79.00
80	80	80.00	80.00	80.00	80.00	80.00	80.00
81	81	81.00	81.00	81.00	81.00	81.00	81.00
82	82	82.00	82.00	82.00	82.00	82.00	82.00
83	83	83.00	83.00	83.00	83.00	83.00	83.00
84	84	84.00	84.00	84.00	84.00	84.00	84.00
85	85	85.00	85.00	85.00	85.00	85.00	85.00
86	86	86.00	86.00	86.00	86.00	86.00	86.00
87	87	87.00	87.00	87.00	87.00	87.00	87.00
88	88	88.00	88.00	88.00	88.00	88.00	88.00
89	89	89.00	89.00	89.00	89.00	89.00	89.00
90	90	90.00	90.00	90.00	90.00	90.00	90.00
91	91	91.00	91.00	91.00	91.00	91.00	91.00
92	92	92.00	92.00	92.00	92.00	92.00	92.00
93	93	93.00	93.00	93.00	93.00	93.00	93.00
94	94	94.00	94.00	94.00	94.00	94.00	94.00
95	95	95.00	95.00	95.00	95.00	95.00	95.00
96	96	96.00	96.00	96.00	96.00	96.00	96.00
97	97	97.00	97.00	97.00	97.00	97.00	97.00
98	98	98.00	98.00	98.00	98.00	98.00	98.00
99	99	99.00	99.00	99.00	99.00	99.00	99.00
100	100	100.00	100.00	100.00	100.00	100.00	100.00

Take home

- Monitor resource condition & activities/land use
- Work with landowner(s) & their objectives
- Different road managers have different sideboards
- Utilize multi-disciplinary team abilities
- Monitor performance & resource condition
